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DRAWINGS ATTACHED

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(54) AN ARRANGEMENT IN MACHINE MILKING

(71) We, ALFA-LAVAL AKTIEBOLAG, a Company organised under the Laws of Sweden, of Fack 147 00 Tumba, Sweden, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to milking machines. Existing milking machines are designed to treat the teat in a constant manner from the moment the teat cup is applied to the teat until the moment the teat cup is removed, irrespective of whether milk flows from the teat or not. However, variations in milk flow from the teat causes variations in the vacuum pressure in the teat cup. An essential disadvantage of this is that the teat is subjected to a higher vacuum when milk is not flowing from the teat, than when milk is flowing. If the teat cups are applied to the cow without sufficient preceding stimulation (release of the suckling reflex) no milk is let down by the cow and the machine will run empty so that full vacuum will then act on the teat, tending to make the teat cup creep up to the udder. The teat is sucked down into the teat cup, and tends to impede the milk flow when it eventually begins; this is very difficult to avoid owing to the teat cup liner design. In this condition the machine also causes the cow a feeling of discomfort, and the cow then shows a tendency to retain her milk, with the consequent risk that the cow may eventually cease to produce milk. The risk of udder injuries is also great.

When the milk flow from the udder has ceased, the vacuum to which the teat is subjected, increases to the full vacuum which the vacuum pump of the plant generates, so that during all empty (idle) running, irrespective of the pulsating system, the teats are treated with this full vacuum. Tests carried out have proved convincingly that the idle running of milking machines can never be avoided. Idle running often takes the place for half the time or more, during which the teat cups are positioned on the udder. The risk of turning out the teat channel opening while constricting the inner diameter of the channel is very great, and such injuries occur with a high frequency. These injuries prolong the milking operation and are also one of the causes for the fact that attendants must treat the udder manually at the end of machine milking operations. The above mentioned creeping of the teats at the start of milking also increases the need for such manual treatment. The possibility of making milking operations more efficient, i.e. to increase the number of milked cows per man hour, would be very great if, either the teat cups could sit on all cows for an equal length of time, i.e., if the idle running were made harmless, or the teat cups could be removed automatically when the milk flow from the teats ceases.

Various prior proposals have been made to the latter end, in accordance with which milk flow rate indicators are employed to initiate operation of mechanical devices which completely shut off the milking vacuum when the milk flow stops, so that the teat cups are released and fall from the udder.

In accordance with the present invention, however, we provide a milking machine including a teat cup cluster having a flow rate sensing means connected thereto and control means actuated by the flow rate sensing means and operative in response to changes in the rate of milk flow from the cluster to vary the degree of milking vacuum applied to the teat cups between a working value and a lower, idling value.

The arrangement enables the teats to be given a gentle vacuum treatment prior to milk flow from the teats, a vigorous treat-

ment (higher degree of milking vacuum) during full milk flow, and a gentle treatment between the end of the milk flow and removal of the teat cup cluster.

The invention is described in more detail in the following description of a preferred embodiment thereof, reference being made to the accompanying drawing, in which:—

Figure 1 shows schematically a milking machine according to the present invention, and

Figure 2, a detail of a modified machine according to the invention.

In Figure 1 a receiving vessel 3 for milk is connected to vacuum pipelines 1 and 2 by means of hoses 4 and 5. One vacuum pipeline has a pressure of, for example, 250 mmHg in it and the other a pressure of 550 mmHg in it. A teat cup cluster 7 is connected to teat cups 12 and 13 by means of milk hoses 8 and 9 and pulsation hoses 10 and 11. For the sake of simplicity the two other teat cups are not shown. A milk hose 14 leads milk from the teat cup cluster via a milk flow rate sensing device 15 and a hose 16 to the vessel 3, which in its turn is provided with a milk outlet 17. Impulses of the milk flow rate sensing device are transmitted by pneumatic means through a hose 18 to a control valve 19. The latter has an inlet 20 for atmospheric air and a hose connection 21 to the vacuum pipeline 2. Two cylinders 22 and 23 of piston and cylinder devices, which are shown in section, are connected to the control valve 19 by means of pipelines 24 to 27. Pistons 28 and 29 operate in the cylinders 22 and 23. An arm pair 32, 33; 34, 35 is articulated in the upper end of each piston rod 30, 31. Each one of the arms 32 to 35 actuates a shut off means 38 to 41, e.g., hose pincher means on the hoses 4 and 5 and on hoses 36 and 37. The hoses 36 and 37 as well as a hose 42 connect the teat cup cluster to the vacuum pipelines 1 and 2, and pulsators 43 and 44 are provided in the hoses 36 and 37.

Instead of the hoses 36 and 37 as well as the pulsators 43 and 44 a pulsator 45 can be provided on the hose 42 as shown with dash-dotted lines.

The arrangement operates in the following manner starting with the moment that the cow lets milk go; the pipeline 1 has the highest vacuum, 250mm Hg, the hose pincher means 38 and 40 are opened and the hose pincher means 39 and 41 are closed. The hose pincher means are so constructed and arranged that, in the same vertical movement of the piston rods 30 and 31, the pincher means 38 and 40 are opened, as the pincher means 39 and 41 are closed, and conversely. Milk flows via the sensing device 15 into the vessel 3. The pulsator 43, which is arranged to generate a pulsation frequency, suitable for the milking operation, and a suitable ratio between the massage and suction periods, e.g., one to three is in operation as the hose pincher means 40 is open. When the milk flow from the cow begins to cease, the following happens: the sensing device 15 records the reduced milk flow and actuates the control valve 19 pneumatically via the hose 18 so that atmospheric air is supplied to the pipelines 24 and 25 from the air inlet 20 of the control valve 19, while the pipelines 26 and 27 are evacuated by the pipeline 2 via the control valve 19 and the hose 21 This means that the upper side of the pistons 28 and 29 is subjected to atmospheric pressure and their underside to vacuum. The pistons 28 and 29 then move downwards to their bottom position, and the piston rods 30 and 31 adjust the hose pincher means 38—41 by means of the arms 32 to 35 so that the vessel 3 is connected to the pipeline 2 with the lower vacuum (550mm Hg) and the pulsator 44 is put into operation, while the pulsator 43 is put out of operation. The pulsator 44 is arranged to generate a frequency and ratio between the massage and suction periods, which are suitable for idle running.

Instead of the pulsators 43 and 44 with the apertaining parts, one can use a pulsator 45 which is arranged such that when it is influenced by the higher vacuum it operates with a frequency suitable for milking and when it is influenced by the lower vacuum, it operates with a frequency suitable for idle running. Pulsators designed to do this are known.

Instead of pneumatic transmission of impulses from the sensing device 15 to the control valve 19, a hydraulic or electric impulse transmission can be used. When transmitting impulses electrically, the control valve 19 and the piston means 22, 23, 28, 29 can be replaced by electromagnetic valves, which replace the pincher means 38 to 41.

Instead of two different vacuum pipeline 1 and 2 one can use a single vacuum pipeline 1a as shown in Figure 2. In this case the hose 6 is connected to the pipeline 1a via a reduction valve 46 and a hose 4a. A pipeline 47 bypasses the reduction valve 46 and has a magnet valve 48 in it which can be actuated by the control valve 19. When an impulse from the sensing device 15 records milk flow, the valve 48 is opened, so that the vessel 3 is put under the same vacuum as that prevailing in the pipeline 1a. In idle running, on the other hand, the valve 48 is closed, and then the vacuum in the vessel 3 sinks as the valve 46 reduces the evacuation through the hose 4a; a valve

body 49 in the valve 46, biased by a spring, throttles the inlet of the hose 6.

The above described milking machine will operate in such a manner that at the start of the milking, before an essential (i.e. a predetermined minimum) milk flow has been reached, the teat will be subjected to a low vacuum only, (e.g. 550 mmHg) which is just sufficient to retain the teat cups on the teats. Also, the degree and frequency of the massage vacuum, applied through pulsator 44, will be at their lower idling values. Thus the teats get a gentle treatment, which assists in increasing the emptying reflex; the manual treatment for stimulating the udder to give off the milk can be completely eliminated. As soon as the milk flow begins, the milk and massage vacuum is increased (e.g. to 250mmHg) and the massage frequency is increased by the changeover from pulsator 44 to pulsator 43. When the milk flow ceases, the vacuum reduces to a value just sufficient to retain the teat cups on the teats. The change of vacuum can in principle take place continuously or stepwise.

The machine may be provided with an additional arrangement (not shown) for automatically removing the teat cups from the teats when the milking operation has been completed.

WHAT WE CLAIM IS:—

1. A milking machine including a teat cup cluster having a flow rate sensing means connected thereto and control means actuated by the flow rate sensing means and operative in response to changes in the rate of milk flow from the cluster to vary the degree of milking vacuum applied to the teat cups between a working value and lower idling value.

2. A milking machine according to claim 1, wherein the control means is operative to vary the degree of massage vacuum applied to the teat cups between an idling value and a higher working value.

3. A milking machine according to claim 1 or 2 wherein the control means is operative to vary the massage frequency of the teat cups, in response to changes in the rate of milk flow, by controlling operation of one or more vacuum pulsators.

4. A milking machine according to any preceding claim wherein the control means is operative to vary the ratio between the massage and suction periods of the teat cups, by controlling one or more vacuum pulsators.

5. A milking machine according to any preceding claim, including a high vacuum source and a low vacuum source, and wherein the control means is operative to connect these sources alternately or together to the teat cups.

6. A milking machine according to claim 5, wherein separate vacuum pulsators are connected to the respective vacuum sources and the control means is operative to bring the pulsators into operation alternately.

7. A milking machine according to any preceding claim, wherein the flow rate sensing means is connected between the teat cup cluster and a milk receiving vessel through which the milking vacuum is applied to the teat cups, and the said control means operates to vary the degree of vacuum within the said vessel.

8. A milking machine substantially as herein described with reference to the accompanying drawings.

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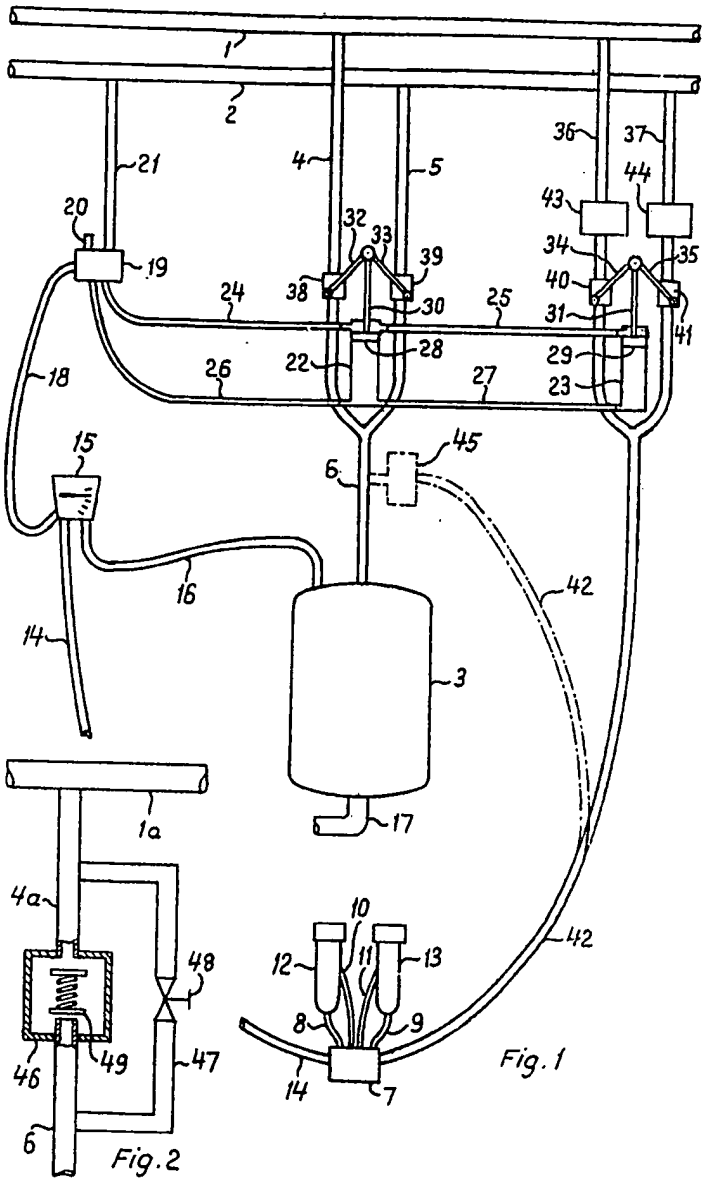

Fig. 1

Fig. 2